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Paper 18
Date: October 26, 2020

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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NRG ENERGY, INC. and
TALEN ENERGY CORPORATION,
Petitioner,

v.

MIDWEST ENERGY EMISSIONS CORP.,
Patent Owner.

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IPR2020-00834
Patent 10,343,114 B2

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Before KRISTINA M. KALAN, CHRISTOPHER M. KAISER, and AVELYN M. ROSS, *Administrative Patent Judges*.

KALAN, *Administrative Patent Judge*.

# DECISION
Granting Institution of *Inter Partes* Review
*35 U.S.C. § 314, 37 C.F.R. § 42.4*

# I. INTRODUCTION

NRG Energy, Inc., Talen Energy Corporation, and Vistra Corp. (formerly known as Vistra Energy Corp.) filed a Petition (Paper 3, "Pet.") requesting an *inter partes* review of claims 1–9 and 12–30 of U.S. Patent No. 10,343,114 B2 (Ex. 1001, "the '114 patent"). Subsequently, Vistra Corp. and Midwest Energy Emissions Corp. ("Patent Owner") filed a Joint Motion to Terminate Vistra Corp. as a petitioner pursuant to a settlement. Paper 11. That motion was granted. Paper 14. Therefore, NRG Energy, Inc. and Talen Energy Corporation (collectively, "Petitioner") remain as petitioners. *Id.* at 4. Patent Owner filed a Preliminary Response to the Petition (Paper 10, "Prelim. Resp."). Pursuant to our authorization, Petitioner filed a Reply (Paper 16, "Pet. Reply"), and Patent Owner filed a Sur-reply (Paper 17, "Sur-reply").

To institute an *inter partes* review, we must determine that the information presented in the Petition shows "there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition." 35 U.S.C. § 314(a). For the reasons discussed below, after considering the parties' submissions and the evidence of record, we determine that Petitioner has demonstrated a reasonable likelihood of prevailing with respect to at least one claim of the '114 patent. Thus, we institute an *inter partes* review.

## *A. Related Proceedings*

The parties identify *Midwest Energy Emissions Corp. v. Vistra Energy Corp.*, No. 1:19-cv-01334-RGA (D. Del.) as a related matter. Pet. 6–7; Paper 6, 2. Petitioner also identifies IPR2020-00832 as a second petition against the '114 patent. Pet. 8.

*B. The '114 Patent*

The '114 patent, titled "Sorbents for the Oxidation and Removal of Mercury," "relates to methods and materials for the removal of pollutants from flue gas or product gas from a gasification system," and "[i]n particular, mercury is removed from gas streams generated during the burning or gasification of fossil fuels by highly reactive regenerable sorbents." Ex. 1001, code (54), 1:27–31. The '114 patent discloses that the "combustion and gasification of fossil fuel such as coal generates flue gas that contains mercury and other trace elements that originate from the fuel" and "[s]everal types of mercury control methods for flue gas have been investigated, including injection of fine sorbent particles into a flue gas duct and passing the flue gas through a sorbent bed." *Id.* at 1:33–35, 1:56–59. The '114 patent explains that a "major problem with existing carbon injection systems is that the sorbent is relatively unreactive toward mercury" and therefore "these sorbents must be used in large amounts." *Id.* at 2:10–12. The '114 patent further describes other mercury sorbent approaches and their problems. *Id.* at 2:20–3:15.

The '114 patent describes a halogen/halide-promoted sorbent "that is highly effective for the removal of mercury from flue gas streams" and that the "sorbent comprises any activated carbon and/or non-carbon compound." *Id.* at 3:36–39. Further, "[o]ptional secondary components and alkali may be added to further increase reactivity and mercury capacity." *Id.* at 3:43–44. The '114 patent states that "the optional secondary component is selected from the group consisting of Group V halides, Group VI halides, HI, HBr, HCl, and combinations thereof." *Id.* at 4:52–55.

The '114 patent discloses in "an embodiment, the promoted sorbent is introduced by direct injection into the flue gas stream" and in "another

embodiment, the base sorbent is promoted within the flue gas stream." *Id.* at 5:41–43. The '114 patent describes that in "some embodiments, the carbon base sorbent and the promoter are introduced into the mercury-containing gas at the same location or at separate locations." *Id.* at 7:5–8. For instance, the '114 explains for one example that "the sorbent is injected into the flue gas after the boiler" and the "additive can be injected where desired (e.g., before, after, or within the boiler)." *Id.* at 30:1–4.

The '114 patent explains that when "a promoted or a non-promoted base sorbent reacts with elemental or oxidized mercury, a mercury/sorbent chemical composition is formed and, in the case of elemental mercury reacting with the promoted base sorbent, the mercury is oxidized." *Id.* at 3:53–57. The '114 patent further describes separating the promoted sorbent from the gas stream and adjusting "the rate at which the carbon base sorbent is introduced or the rate at which the promoter is introduced or combination thereof" according to a monitored mercury content of the cleaned gas "so that the mercury content of the cleaned gas is maintained at substantially the desired level with minimal operating cost." *Id.* at 7:10–16.

*C. Illustrative Claim*

1. A method of separating mercury from a mercury containing gas, the method comprising:
combusting coal in a combustion chamber, to provide the mercury-containing gas, wherein the mercury-containing gas comprises a halogen or halide promoter comprising HBr, Br-, or a combination thereof, wherein
the coal comprises added $Br_2$, HBr, Br-, or a combination thereof, added to the coal upstream of the combustion chamber, or
the combustion chamber comprises added $Br_2$, HBr, Br-, or a combination thereof, or
a combination thereof;

injecting a sorbent material comprising activated carbon into the mercury-containing gas downstream of the combustion chamber;
contacting mercury in the mercury-containing gas with the sorbent, to form a mercury/sorbent composition;
separating the mercury/sorbent composition from the mercury-containing gas, to form a cleaned gas;
monitoring the mercury content of the cleaned gas; and
controlling, in response to the monitored mercury content of the cleaned gas, an injection rate of injecting the sorbent into the mercury-containing gas, the sorbent composition, or a combination thereof, so that the mercury content of the cleaned gas is maintained at or below a desired level.

Ex. 1001, 33:49–34:7.

*D. The Asserted Grounds of Unpatentability*

Petitioner contends claims 1–9 and 12–30 of the '114 patent are unpatentable on the following grounds:

| Reference(s) | Basis | Claim(s) Challenged |
|---|---|---|
| Vosteen[1] | § 102 | 23–28, 30 |
| Vosteen | § 103 | 1–9, 12–30 |
| Downs-Boiler[2] | § 102 | 23, 25–27, 30 |
| Downs-Boiler | § 103 | 1–7, 12–28, 30 |
| Vosteen, EPA- | § 103 | 1–7,[4] 12–22, 24, 28 |

[1] US 6,878,358 B2, issued Apr. 12, 2005 (Ex. 1008).
[2] US 2008/0107579 A1, published May 8, 2008 (Ex. 1006). Although the first inventor is named Downs (*id.* at code (76)), we follow the parties' practice of referring to this reference as "Downs-Boiler."
[4] In its Identification of Challenged Claims, Petitioner states this Ground 5 challenges claims 1–7, 12–22, 24, and 28 (Pet. 10), but then states that "Ground 5 explains why Claims 1–9, 12–22, 24, and 28 would have been obvious over Downs-Boiler in view of EPA-Proposal." *Id.* at 67. Clarification is requested.

| Reference(s) | Basis | Claim(s) Challenged |
|---|---|---|
| Proposal[3] | | |
| Downs-Boiler, EPA-Proposal | § 103 | 1–9,[5] 12–22, 24, 28 |
| Vosteen, Nelson[6] | § 103 | 2–4, 17, 18, 24, 29, 30 |
| Downs-Boiler, Nelson | § 103 | 2–4, 18, 24, 29, 30 |

In support of its unpatentability arguments, Petitioner relies on the declaration testimony of Dr. Stephen Niksa. Ex. 1002.

## II. ANALYSIS

### *A. Claim Construction*

We apply the claim construction standard articulated in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005). 37 C.F.R. § 42.100(b) (2019); *see also Changes to the Claim Construction Standard for Interpreting Claims in Trial Proceedings Before the Patent Trial and Appeal Board*, 83 Fed. Reg. 51,340 (Oct. 11, 2018) (applicable to *inter partes* reviews filed on or after November 13, 2018). Under *Phillips*, claim terms are afforded "their ordinary and customary meaning." *Phillips*, 415 F.3d at 1312. "[T]he ordinary and customary meaning of a claim term is the meaning that the

[3] Proposed National Emission Standards for Hazardous Air Pollutants; and, in the Alternative, Proposed Standards of Performance for New and Existing Stationary Sources: Electric Utility Steam Generating Units, 69 Fed. Reg. 4652–4752 [Volume 69, No. 20] (Jan. 30, 2004) (Ex. 1009).
[5] In its Identification of Challenged Claims, Petitioner states this Ground 6 challenges claims 1–9, 12–22, 24, and 28 (Pet. 10), but then states that "Ground 6 explains why Claims 1–7, 12–22, 24, and 28 would have been obvious over Downs-Boiler in view of EPA-Proposal." *Id.* at 67. Clarification is requested.
[6] US 6,953,494 B2, issued Oct. 11, 2005 (Ex. 1012).

term would have to a person of ordinary skill in the art in question at the time of the invention." *Id.* at 1313. Only terms that are in controversy need to be construed, and then only to the extent necessary to resolve the controversy. *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999).

Petitioner does not assert a claim construction for the challenged claims. *See* Pet 22. Patent Owner contends that all challenged claims of the '114 patent require "injecting a sorbent material comprising activated carbon into the mercury-containing gas downstream of the combustion chamber" and Petitioner appears "to implicitly interpret this limitation more broadly than the plain meaning of the words." Prelim. Resp. 14. Patent Owner requests that the Board construe this limitation "to require that the sorbent material comprising activated carbon be injected into the duct, pipe, or other structure that contains the mercury containing gas." *Id.* Patent Owner asserts that this meaning is consistent with the claim language and the specification of the '114 patent, which describes the injection of sorbent into flue gas but not placing a sorbent-coated filter in a passageway and exposing the passageway to mercury-containing gas. *Id.* at 14–15 (citing Ex. 1001, 14:5–9, 14:10–25). According to Patent Owner, this "contrasts with Petitioners' interpretation of this limitation as encompassing blowing activated carbon into a filter, placing the filter in a structure, and then transporting mercury containing gas to the structure." *Id.* at 14.

Having considered Patent Owner's argument, we agree that "injecting a sorbent material comprising activated carbon into the mercury-containing gas downstream of the combustion chamber" does not encompass blowing activated carbon into a filter, placing the filter in a structure, and then transporting mercury containing gas to the structure. However, we decline

to use Patent Owner's proposed construction, which introduces a structure to convey the mercury-containing gas. The plain meaning of the claim language is that the sorbent material is injected into the mercury-containing gas, not vice versa (e.g., that the mercury-containing gas is passed over or through the sorbent material).

*B. Principles of Law*

"In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable." *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify "with particularity . . . the evidence that supports the grounds for the challenge to each claim")). This burden of persuasion never shifts to Patent Owner. *See Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (discussing the burden of proof in *inter partes* review).

To anticipate a claim under 35 U.S.C. § 102, "a single prior art reference must expressly or inherently disclose each claim limitation." *Finisar Corp. v. DirecTV Grp., Inc.*, 523 F.3d 1323, 1334 (Fed. Cir. 2008). Accordingly, "the dispositive question regarding anticipation [i]s whether *one skilled in the art* would reasonably understand or infer from the [prior art reference's] teaching" that every claim element was disclosed in that single reference. *Dayco Prods., Inc. v. Total Containment, Inc.*, 329 F.3d 1358, 1368 (Fed. Cir. 2003).

A claim is unpatentable under § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.

*KSR Int'l Co. v. Teleflex Inc*., 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) when in evidence, objective indicia of non-obviousness (i.e., secondary considerations). *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). "To satisfy its burden of proving obviousness, a petitioner cannot employ mere conclusory statements. The petitioner must instead articulate specific reasoning, based on evidence of record, to support the legal conclusion of obviousness." *In re Magnum Oil Tools Int'l, Ltd.*, 829 F.3d 1364, 1380 (Fed. Cir. 2016).

We analyze the asserted grounds of unpatentability in accordance with these principles to determine whether Petitioner has met its burden to establish a reasonable likelihood of success at trial.

*C. Level of Ordinary Skill in the Art*

Petitioner argues:

> A person of ordinary skill in the art ("POSITA") would have at least a bachelor's degree in chemical engineering, mechanical engineering, or a related field of study with at least two years of experience with implementing pollution control in power generation plants for natural gas, coal, and/or industrial waste incineration.

Pet. 14 (citing Ex. 1002 ¶ 64). Patent Owner does not appear to dispute this proposed definition. *See generally* Prelim. Resp. Neither party argues that the outcome of this case would differ based on our adoption of any particular definition of one of ordinary skill in the art.

In light of the record before us, we adopt Petitioner's proposal regarding the level of one of ordinary skill in the art. The level of ordinary

skill in the art is also reflected by the prior art of record. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001).

*D. Real Parties-In-Interest*

Petitioner identifies a number of real parties-in-interest and potential real parties-in-interest. Pet. 1–6.

Patent Owner argues that "35 U.S.C. § 312(a)(2) provides that a petition may only be considered if 'the petition identifies all real parties in interest.'" Prelim. Resp. 7. Patent Owner contends that Petitioner lists "dozens of 'potential real parties in interest,' without explanation as to their relationship to petitioners," that this "is not an identification of all real parties in interest," and that, if instituted, this proceeding would be under a cloud of uncertainty because the ambiguity in Petitioner's list "will likely lead to confusion and disputes as to which parties are real parties in interest and which are bound by the estoppel provisions of 35 U.S.C. § 315." *Id*. For instance, Patent Owner asserts that Petitioner identifies various vendors and suppliers as "potential real parties in interest" but states that "[n]one of these companies or any unnamed entity is funding, controlling, or directing, or otherwise has an opportunity to control or direct this Petition or proceeding" and this implies that these entities are not actually real parties in interest. *Id.* at 7–8. In addition, Patent Owner argues that some entities are identified both as "potential real parties in interest" and "real parties in interest," which creates ambiguity and conflict in the listing of entities. *Id.* at 8.

For these reasons, Patent Owner contends that "Petitioners have not met their burden of identifying all real parties in interest" and "the Board should deny institution for failure to comply with § 312(a)(2)." *Id.* at 8–9.

We are not made aware of any rule, statute, or case law that prohibits Petitioner from identifying multiple real parties-in-interest or multiple potential real parties-in-interest. Petitioner's identification of about a dozen real parties-in-interest does not appear problematic or overly burdensome. Pet. 1–2. Petitioner's identification of numerous potential real parties-in-interest, while unusual, also does not appear problematic. *Id.* at 2–6. To the extent Petitioner has identified an entity as both a real parties-in-interest and as a potential real parties-in-interest, we interpret that to mean that party is identified as a real party-in-interest. Petitioner's reasons for identifying numerous potential real parties-in-interest reasons appear plausible: Petitioner identifies these parties "out of an abundance of caution" because "they are vendors and suppliers" in the related litigation but have not "agreed to be listed as a real party-in-interest" in this Petition. Pet. 1–6. This provides the Board and Patent Owner notice that other potential entities may be indirectly involved, but also provides reasons for not committing those parties to the real party-in-interest category. Ordinarily, problems regarding identification of real parties-in-interest arise when a petitioner fails to identify a real party-in-interest. *See, e.g., Ventex Co., Ltd. v. Columbia Sportswear N. Am., Inc.*, IPR2017-00651, Paper 152 (PTAB Jan. 24, 2019) (precedential) (terminating proceeding where Petition failed to name time-barred RPI and privy). Here, the alleged problem is over-identification of potential real parties-in-interest. Without express violation of a known rule, statute, or case law, however, this does not appear to be a problem warranting non-institution of *inter partes* review.

*E. Asserted Anticipation by Vosteen (Ground 1)*

Petitioner argues that claims 23–28 and 30 are anticipated by Vosteen. Pet. 22–29.

*1. Vosteen*

Vosteen is a patent titled "Process for Removing Mercury from Flue Gases." Ex. 1008, code (54). Vosteen "relates to a process for removing mercury from flue gases of high-temperature plants, in particular power stations and waste incineration plants." *Id.* at 1:6–8. Specifically, Vosteen describes:

> The invention relates to a process for removing mercury from flue gases of high-temperature plants, in particular from power stations and waste incineration plants, in which bromine and/or a bromine compound and/or a mixture of various bromine compounds is fed to the if appropriate multistage furnace and/or to the flue gas in a plant section downstream of the furnace, the temperature during the contact of the bromine compound with the flue gas being at least 500° C., preferably at least 800° C., the combustion taking place in the presence of a sulphur compound, in particular sulphur dioxide, with or without the addition of sulphur and/or a sulphur compound and/or of a mixture of various sulphur compounds, and then the flue gas being subjected to an if appropriate multistage cleanup for removing mercury from the flue gas, which cleanup comprises a wet scrubber and/or a dry cleanup.

*Id.* at 1:66–2:14.

Vosteen discloses that the bromine compound may be sodium bromide and can be in the form of a salt that can be added to waste mixture, coal, or the like to be burnt. *Id.* at 4:4–8. Vosteen describes a flue gas emission control system including a dry emission control system that may use, for example, "cloth filters which are impinged with a blown-in finely pulverulent slaked lime/activated carbon or slaked line/lignite coal coke mixture." *Id.* at 5:19–30. Vosteen further describes continuously measuring the mercury content of the flue gas and controlling the amount and/or

mixture of bromine and/or bromine compound fed by Vosteen's emission control system. *Id.* at 5:48–54.

*2. Unpatentability Analysis*

Petitioner discusses claim 25 first, because "the other independent claims copy its limitations." Pet. 22 (citing Ex. 1002 ¶¶ 290, 298, 323). Regarding the preamble of claim 25, Petitioner asserts that Vosteen discloses a "process for removing mercury from flue gases." *Id.* at 23 (quoting Ex. 1008, code (54)).

For the limitation "combusting coal in a combustion chamber, to provide the mercury-containing gas," Petitioner contends that "Vosteen discloses 'feeding the coal to the furnace' and 'carrying out a combustion or incineration process, within the furnace' to provide the mercury-containing gas." *Id.* (citing Ex. 1008, claim 1, 18, 7:25–28, 10:63–11:6, 11:23–24, Figs. 7–9; Ex. 1002 ¶ 271).

Regarding the limitation "the coal comprises added Br2, HBr, a bromide compound, or a combination thereof, added to the coal upstream of the combustion chamber, or the combustion chamber comprises added Br2, HBr, a bromide compound, or a combination thereof, or a combination thereof," Petitioner argues that Vosteen discloses adding bromine-containing ingredients, such as $Br_2$, HBr, and/or sodium bromide into one of its combustion chambers and/or to coal to be burnt. *Id.* (citing Ex. 1008, 2:54–61, 4:4–33, claims 1, 2, 18; Ex. 1002 ¶¶ 272–273).

For the limitation "injecting a sorbent material comprising activated carbon into the mercury-containing gas downstream of the combustion chamber; contacting mercury in the mercury-containing gas with the sorbent, to form a mercury/sorbent composition," Petitioner argues that "Vosteen discloses a dry-emission control system that injects activated-

carbon sorbent into the mercury-containing gas downstream of the combustion chamber" because the dry-emission control system has "cloth filters … impinged with … blown-in finely pulverant slaked lime/activated carbon." *Id.* at 24 (citing Ex. 1008, 5:27–30). Petitioner asserts that "'[b]low[ing] in' activated carbon is a form of injecting the sorbent into a mercury-containing gas" and "Vosteen confirms that mercury removal in the dry-emission system is 'from the flue gases…downstream of the combustion.'" *Id.* (citing Ex. 1008, 2:16–19, claims 1, 12; Ex. 1002 ¶¶ 274–278). Petitioner further argues that mercury in Vosteen's flue gas "is adsorbed, and thus contacted, with the activated-carbon sorbent to form a mercury/sorbent composition." *Id.* at 24–25 (citing Ex. 1008, 2:20–31, 5:19–39; Ex. 1002 ¶¶ 279–280.

For the limitation "separating the mercury/sorbent composition from the mercury-containing gas, to form a cleaned gas," Petitioner argues that "Vosteen separates the mercury/sorbent composition from the mercury-containing (flue) gas using a cloth-fabric filter with activated carbon to provide 'for the substantially complete removal of mercury (Hg).'" Pet. 25 (citing Ex. 1008, 5:15–30, 5:50–53, 6:2–4, claims 1, 10, 18; Ex. 1002 ¶¶ 281–282).

Patent Owner contends that "[a]ll of the challenged claims of the '114 Patent require 'injecting a sorbent material comprising activated carbon into the mercury-containing gas downstream of the combustion chamber.'" Prelim. Resp. 29. Patent Owner asserts that Petitioner has "failed to provide evidence demonstrating that a POSITA would understand Vosteen to describe activated carbon injection into a mercury-containing gas." *Id.* at 31. Patent Owner argues there are various technologies for capturing particulate matter, such as fly ash, and one such technology is termed a

"baghouse." *Id.* at 32. Patent Owner asserts that a "baghouse contains cylindrical filters made of a woven or felted cloth such as fiber glass or nylon." *Id.* (citing Ex. 1027). Patent Owner argues that "gas is pulled or pushed through the filters to generate a cleaned gas" and when "particulates first come into contact with a baghouse filter, some of the particulates impinge and become trapped on the fabric fibers." *Id.* at 32–33 (citing Ex. 1027, 33–38). Patent Owner contends that these particulates "trap additional incoming particulates" and. ultimately, "the primary filtration mechanism comes from the particles on the filter, known as the 'dust cake,' rather than the filter medium itself." *Id.* at 33–34 (citing Ex. 2018, 7).

Patent Owner asserts that for decades, "POSITA have recognized that the flue gas exiting a coal combustion chamber contains high velocity particles and acid gases," which can damage fabric filters. *Id.* at 34. Patent Owner argues that operators "can reduce this risk by applying a protective dust layer, known as a 'precoat' to the filters before bringing them online," which "provides a protective layer and promotes dust cake formation." *Id.* (citing Ex. 2019, 2; Ex. 2020, 7–9). Patent Owner further asserts that "the EPA has explained that various coatings may be blown onto filter bags before using them in operation," including the injection of limestone to precoat bags to aid the filtering mechanism before initial dust cake formation. *Id.* at 34–35 (citing Ex. 2018, 7, 15; Ex. 2021, 5).

Patent Owner contends that Petitioner has failed to show that Vosteen discloses injecting activated carbon sorbent into a mercury-containing gas, as the challenged claims recite. *Id.* at 35. Patent Owner argues that Petitioner asks "the Board to infer that Vosteen's description of 'blowing in' is the same as 'injecting'" but Petitioner fails "to show that Vosteen teaches injecting activated carbon into the *mercury-containing gas*, rather than onto

cloth filters." *Id.* Citing their argument that "a POSITA would have been aware of the process of precoating filter bags to support development of a filter cake *before* exposing them to mercury containing gas," Patent Owner contends that Petitioner fails "to prove that a POSITA would interpret Vosteen's statement as anything other than a description of precoating cloth filters outside of a baghouse or during scheduled maintenance when the filters are not exposed to mercury-containing gas." *Id.* at 36 (citing Ex. 2018, 7, 15). In view of the above, Patent Owner asserts that Petitioner has failed to show that Vosteen discloses injecting a sorbent downstream of a combustion chamber. *Id.* at 37–39.

Petitioner replies that "Patent Owner relies on counsel's interpretation of four extraneous reports to rewrite Vosteen," "Exhibits 2018 and 2020 date from 1979 and 1982, and Exhibit 2019 relates to using 'diatomaceous earth … available from retail garden centers,'" and "[n]one of the four reports (Ex. 2018–2021) discuss activated carbon or removing mercury from flue gases." Pet. Reply. 10. Petitioner argues that, though "Patent Owner's counsel hypothesizes that a generic fabric filter *could* be 'precoated' with materials 'prior to bringing the unit on-line' in certain circumstances (POPR at 34), that does not preclude injecting activated carbon into the filter of Vosteen *after* it goes online." *Id.* Petitioner further argues that they have provided expert testimony "that Vosteen '*describes injecting* a mixture of lime and activated carbon onto fabric filters *downstream of the combustion chamber* [which] spontaneously brominates the activated carbon (sorbent) in the mercury-containing flue gas *as both the activated-carbon sorbent and the bromine-containing species move towards the fabric filter unit*.'" *Id.* (citing Ex. 1002 ¶¶ 275–278). Petitioner asserts that any "genuine issue of material fact created by 'testimonial evidence will be viewed in the light

most favorable to the petitioner' prior to institution," and "Petitioners' expert should be given even more weight here, where Patent Owner did not submit *any* testimonial evidence regarding Vosteen, instead submitting unsponsored and irrelevant exhibits." *Id.* (citing 37 C.F.R. § 42.108(c)).

In its Sur-reply, Patent Owner reiterates that Vosteen fails to disclose injecting activated carbon and asserts that Petitioner "merely restate[s] their expert's testimony that these elements are disclosed in Vosteen," but "that testimony is merely a conclusion with no analysis or citation to the actual words used in Vosteen" that cannot sustain their burden. Sur-reply 9–10 (citing *TQ Delta, LLC v. CISCO Sys., Inc.*, 942 F.3d 1352, 1362 (Fed. Cir. 2019)).

Vosteen describes a flue gas emission control system including a dry emission control system that may use, for example, "cloth filters which are impinged with a blown-in finely pulverulent slaked lime/activated carbon or slaked lime/lignite coal coke mixture." Ex. 1008, 5:19–30. Petitioner asserts that "'[b]low[ing] in' activated carbon is a form of injecting the sorbent into a mercury-containing gas" but does not explain how a blown in activated carbon on Vosteen's cloth filters would result in the activated carbon being injected into gas, as the challenged claims require. Pet. 24.

Dr. Niksa declares:

> Vosteen describes adding bromine-containing species to the coal (and/or or to the combustion chamber) to introduce HBr and other bromine-containing species into the mercury-containing flue gas generated in the combustion chamber, *and also describes injecting a mixture of lime and activated carbon onto fabric filters downstream of the combustion chamber*. This treatment configuration spontaneously brominates the activated carbon (sorbent) in the mercury-containing flue gas as both the activated-carbon sorbent and the bromine-containing species move towards the fabric filter unit. The bromination also occurs

> in the dust cakes of fly ash, activated carbon, and lime on the outer bag surfaces. In turn, the brominated activated carbon captures elemental and oxidized mercury at extremely high efficiency, due to the large concentration of brominated sites in the activated carbon in a dust cake.

Ex. 1002 ¶ 276 (citing Ex. 1008, 5:27–30) (emphasis added). However, Dr. Niksa provides no explanation how Vosteen "also describes injecting a mixture of lime and activated carbon onto fabric filters downstream of the combustion chamber," as Dr. Niksa states above. Nor does Petitioner provide evidence (other than Dr. Niksa's testimony) that Vosteen's arrangement of cloth filters impinged with a mixture would result in the mixture being injected into gas that passes through the cloth filters (e.g., due to release of the mixture from the cloth filters into the gas). Thus, given the lack of support, we are not persuaded that Petitioner's testimonial evidence regarding whether Vosteen discloses the injection of a sorbent material is entitled to much weight.

Conversely, Patent Owner cites evidence explaining the nature of Vosteen's cloth filters and how particles would cake upon them. Prelim. Resp. 31–35. Considering the parties' positions and weighing the evidence before us, we determine, on this record, that Petitioner has not demonstrated a reasonable likelihood that Vosteen discloses the injection of sorbent material comprising activated carbon into a mercury-containing gas, as the challenged claims require.

In view of the foregoing, Petitioner has not demonstrated a reasonable likelihood of prevailing on its assertion that claim 25 of the '114 patent is anticipated by Vosteen.

Petitioner presents separate arguments for claims 23, 24, 26–28, and 30. Pet. 26–29. Petitioner's arguments, however, do not remedy the

deficiencies discussed above with regard to claim 25, which are common to all claims challenged under this ground. Therefore, Petitioner has not demonstrated a reasonable likelihood of prevailing on its assertion that claim 23, 24, 26–28, and 30 of the '114 patent are anticipated by Vosteen.

*F. Asserted Obviousness over Vosteen (Ground 2)*

Petitioner argues that claims 1–9 and 12–30 are unpatentable over Vosteen. Pet. 29–43. Petitioner relies on the arguments regarding claims 23–28 and 30 presented in its Ground 1, and provides additional arguments directed to claims 1–9, 12–22, and 29. *Id.*

Patent Owner, referring to its anticipation-based arguments against Vosteen, argues that Petitioner does not offer any additional analysis in its obviousness grounds explaining how a person of ordinary skill in the art would have been motivated to modify Vosteen to arrive at the sorbent injection limitations of the challenged claims. Prelim. Resp. 29. We agree, because Petitioner's arguments for this ground do not remedy the deficiencies discussed above with regard to Petitioner's anticipation arguments based on Vosteen. Therefore, Petitioner has not demonstrated a reasonable likelihood of prevailing on its assertion that claims 1–9 and 12–30 of the '114 patent would have been unpatentable over Vosteen.

*G. Asserted Anticipation by Downs-Boiler (Ground 3)*

Petitioner argues that claims 23, 25–27, and 30 are anticipated by Downs-Boiler. Pet. 44–50.

*1. Downs-Boiler*

Downs-Boiler is a patent publication titled "Bromine Addition for the Improved Removal of Mercury from Flue Gas." Ex. 1006, code (54). Downs-Boiler explains that bromine-containing compounds, "added to the coal, or to the boiler combustion furnace, are used to enhance the oxidation

of mercury, thereby enhancing the overall removal of mercury in downstream pollution control devices." *Id.* at code (57).

Downs-Boiler's Figure 2 is reproduced below:

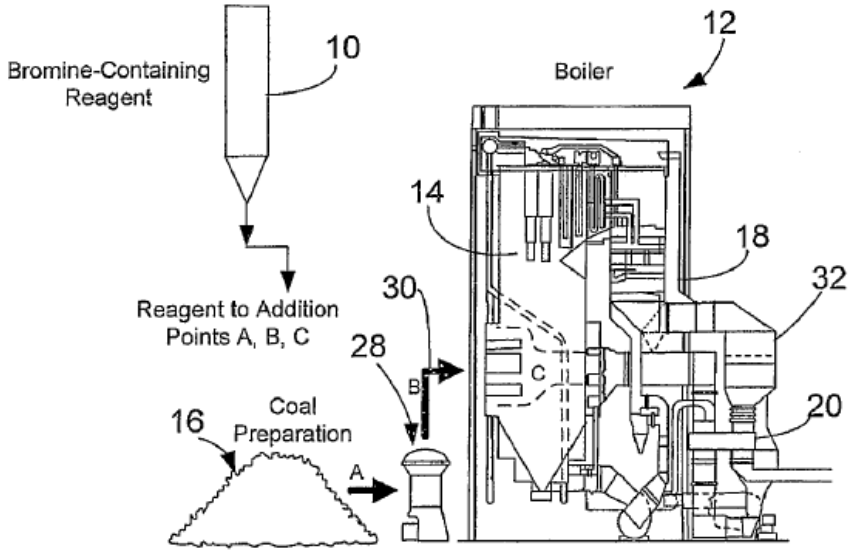



FIG. 2

Figure 2 shows adding bromine to improve mercury removal from flue gases. *Id.* ¶ 10. Downs-Boiler discloses that bromine-containing reagent 10 is added to boiler 12 of combustion furnace 14 "either directly or by premixing with the incoming coal 16." *Id.* ¶ 15. Downs-Boiler describes the use of an aqueous solution of calcium bromide for injection into the combustion chamber 14, and the use of HBr or $Br_2$ as the bromine-containing reagent 10. *Id.* ¶¶ 18, 21. Downs-Boiler also discloses "powdered activated carbon (PAC)" as a sorbent, and describes "downstream pollution control systems such as wet 22 and SDA 24 FGD systems, and PAC injection systems." *Id.* ¶¶ 15, 25. Downs-Boiler states that "experimental results indicate that bromine addition also results in an increased fraction of particulate-bound mercury." *Id.* ¶ 15.

*2. Unpatentability Analysis*

Petitioner discusses claim 25 first, asserting this is done "because the other independent claims copy its limitations." Pet. 45 (citing Ex. 1002 ¶ 388). Specifically, Petitioner argues the following:

Preamble: "A method of separating mercury from a mercury-containing gas, the method comprising:" (Pet. 46 (relying on Ex. 1006, code (54); Ex. 1007, code (54); Ex. 1002 ¶ 389));

Element 25(a): "combusting coal in a combustion chamber, to provide the mercury-containing gas" (Pet. 46 (relying on Ex. 1006 ¶¶ 1, 20, Fig. 4; Ex. 1007 ¶¶ 2, 3, 9, 18, 23, Fig. 4; Ex. 1002 ¶¶ 390–391));

Element 25(b): "the coal comprises added $Br_2$, HBr, a bromide compound, or a combination thereof, added to the coal upstream of the combustion chamber, or the combustion chamber comprises added $Br_2$, HBr, a bromide compound, or a combination thereof, or a combination thereof," (Pet. 46–47 (relying on Ex. 1006 ¶¶ 7, 18, 19, 21, 22, Fig. 2; Ex. 1007 ¶¶ 9, 21, 22, 24, 25, Fig. 2; Ex. 1002 ¶¶ 392–398));

Element 25(c): "injecting a sorbent material comprising activated carbon into the mercury-containing gas downstream of the combustion chamber; contacting mercury in the mercury-containing gas with the sorbent, to form a mercury/sorbent composition" (Pet. 48 (relying on Ex. 1006 ¶¶ 3, 4, 15, 16; Ex. 1007 ¶¶ 5, 18, 19; Ex. 1002 ¶¶ 399–402));

Element 25(d): "separating the mercury/sorbent composition from the mercury-containing gas, to form a cleaned gas." (Pet. 48 (relying on Ex. 1006 ¶ 4; Ex. 1007 ¶ 5; Ex. 1002 ¶ 403).

Petitioner asserts that "[c]laim 23 is nearly identical to Claim 25, with minor changes" and argues that Downs-Boiler discloses the limitation "wherein the mercury-containing gas comprises a halogen or halide

promoter comprising HBr, $Br^-$ or a combination thereof." *Id.* at 49–50 (relying on Ex. 1006 ¶¶ 18, 19, 21, Fig. 2; Ex. 1007 ¶¶ 21, 22, Fig. 2; Ex. 1002 ¶¶ 407–415).

Petitioner presents separate arguments for claims 26, 27, and 30. Pet. 49. Patent Owner does not address Petitioner's arguments regarding the claims challenged under this ground, aside from arguing a prior date of invention for the '114 patent, as discussed below. Based on the preliminary record before us, we find that Petitioner's arguments and evidence are sufficient to show a reasonable likelihood Petitioner would prevail in proving unpatentability of claims 23, 25–27, and 30.

*H. Asserted Obviousness over Downs-Boiler (Ground 4)*

Petitioner argues that claims 1–7, 12–28, and 30 are unpatentable over Downs-Boiler. Pet. 50–67.

Petitioner asserts that claim 1 "combines the limitations of Claims 23 and 25" and thus the above analysis in the anticipation ground over Downs-Boiler applies to claim 1. *Id.* at 51. Petitioner also provides arguments for the following limitations:

Element 1(e): "monitoring the mercury content of the cleaned gas" (Pet. 52 (relying on Ex. 1006; Ex. 1007, Fig. 3; Ex. 1002 ¶ 429));

Element 1(f)(1): "controlling, in response to the monitored mercury content of the cleaned gas, an injection rate of injecting the sorbent into the mercury-containing gas, the sorbent composition, or a combination thereof," (Pet. 52–53 (arguing "a POSITA would have been motivated to at least try adjusting, in response to the monitored mercury content, the sorbent injection rate at a level that minimized costs while reaching mercury content removal targets" and relying on Ex. 1006 ¶ 4; Ex. 1007 ¶ 5, Fig. 3; Ex. 1002 ¶¶ 430–431));

Element (1)(f)(2): "so that the mercury content of the cleaned gas is maintained at or below a desired level." (Pet. 54 (relying on Ex. 1006 ¶ 1; Ex. 1007 ¶ 2; Ex. 1002 ¶ 432)).

Petitioner also presents arguments and evidence that Downs-Boiler suggests the limitations of dependent claims 2–7 and 12–22. Pet. 54–63.

Petitioner asserts that claims 23, 25–27, and 30 "are obvious for the same reasons as in Ground 3, as anticipation is the epitome of obviousness," those claims are also obvious for the reasons discussed in this ground, and "[e]lements and claims not mentioned below are disclosed or rendered obvious for the reasons stated above" in the anticipation ground over Downs-Boiler. Pet. 50 (citing Ex. 1002 ¶ 416). Petitioner also provides arguments for the limitations "contacting mercury in the mercury-containing gas with the sorbent, to form a mercury/sorbent composition" of claims 23 and 25 and the limitation "the mercury sorbent composition comprises the element bromine, the sorbent material, and mercury" of claim 30. *Id.* at 51.

Petitioner asserts that claim 24 "combines the limitations of Claims 1, 23 and 25" and for "the same reasons, Downs-Boiler also renders obvious Claim 24." Pet. 64 (citing Ex. 1002 ¶¶ 290, 298, 323, 463–473). Petitioner also provides arguments for the following limitations:

Element 24(c): "the activated carbon reacts with the halogen or halide promoter in the mercury-containing gas to form a promoted sorbent" and the mercury is contacted "with the promoted sorbent" (Pet. 64–65 (relying on Ex. 1006 ¶ 4; Ex. 1007 ¶ 5; Ex. 1002 ¶¶ 467–468));

Element 24(f)(1): "controlling, in response to the mercury content of the cleaned gas, an injection rate of injecting the sorbent into the mercury-containing gas, *a rate of addition to the coal or the combustion chamber of the added Br2, HBr, the bromide compound*, or a combination thereof, or a

combination thereof." (Pet. 65–66 (arguing that one of ordinary skill in the art, upon reviewing the test data presented in Downs-Boiler's Figure 3, "would have been motivated to control the bromine addition rate in response to fluctuations in mercury content, such as by selecting a given addition rate . . . and/or by interpolating an intermediate value in response to the monitored mercury content of the cleaned gas" and relying on Ex. 1006 ¶ 18, Fig. 3; Ex. 1007 ¶ 21, Fig. 3; Ex. 1002 ¶¶ 471–472)).

Petitioner argues that claim 28 "combines Elements 24(e), 24(f)(1), and 24(f)(2), and is obvious for the same reasons." Pet. 67 (citing Ex. 1002 ¶¶ 474–477).

Patent Owner does not present arguments addressing the specific merits of Petitioner's obviousness ground based on Downs-Boiler in the Preliminary Response to the Petition. *See generally* Prelim. Resp. Based on the preliminary record before us, we find that Petitioner's arguments and evidence are sufficient to show a reasonable likelihood Petitioner would prevail in proving unpatentability of claims under this ground. In view of the foregoing, Petitioner has demonstrated a reasonable likelihood of prevailing on its assertion that claims 1–7, 12–28, and 30 of the '114 patent are unpatentable over Downs-Boiler.

*I. Asserted Obviousness over Vosteen and EPA-Proposal (Ground 5)*

Petitioner argues that claims 1–9, 12–22, 24, and 28 are unpatentable over Vosteen and EPA-Proposal. Pet. 67–74.

*1. EPA-Proposal*

EPA-Proposal is a publication of "Proposed National Emission Standards for Hazardous Air Pollutants; and, in the Alternative, Proposed Standards of Performance for New and Existing Stationary Sources: Electric Utility Steam Generating Units" in the Federal Register. Pet. 67; Ex. 1009,

2. EPA-Proposal states that the "primary goal in this rulemaking is to reduce power plant emissions of Hg by 70 percent from today's level by 2018." *Id.* at 48. EPA-Proposal describes the use of sorbent injection to improve the removal of mercury and other gaseous pollutants that are carried with combustion fine particulates in all coal-fired subcategories. *Id.* at 26. EPA-Proposal discloses that the sorbent can be activated carbon and "the types of sorbent that may be viable for use in sorbent injection include two basic types of activated carbon (AC; regular and impregnated), as well as other carbon (mixed with other sorbents) and non-carbon sorbents." *Id.*

*2. Analysis*

Petitioner's arguments for this ground do not remedy the deficiencies discussed above with regard to Ground 1 over Vosteen. Pet. 67–74. Therefore, Petitioner has not demonstrated a reasonable likelihood of prevailing on its assertion that claims 1–9, 12–22, 24, and 28 of the '114 patent would have been unpatentable over Vosteen and EPA-Proposal.

*J. Asserted Obviousness over Downs-Boiler and EPA-Proposal (Ground 6)*

Petitioner argues that claims 1–7, 12–22, 24, and 28 are unpatentable over Downs-Boiler and EPA-Proposal. Pet. 67–74.

Patent Owner does not present arguments addressing the specific merits of Petitioner's ground in the Preliminary Response. Having reviewed Petitioner's assertions regarding claims 1, 2, 3, 13, 14, 24, and 28, as well as the cited portions of Downs-Boiler and EPA-Proposal, we determine that Petitioner has demonstrated a reasonable likelihood of establishing that claims 1, 2, 3, 13, 14, 24, and 28 would have been obvious over Downs-Boiler and EPA-Proposal.

We have reviewed Petitioner's argument and evidence that Downs-Boiler and EPA-Proposal disclose the limitations of the remaining challenged claims 4–7, 12, and 15–22. Pet. 67 ("Elements and claims not mentioned below are disclosed or rendered obvious for the reasons stated above in . . . Grounds 3–4 (Downs-Boiler)."), 67–74. Patent Owner does not address Petitioner's challenges to these challenged claims. Based on the preliminary record before us, we also find that Petitioner's argument and evidence is sufficient to show a reasonable likelihood Petitioner would prevail in proving unpatentability of dependent claims 4–7, 12, and 15–22.

*K. Asserted Obviousness over Vosteen and Nelson (Ground 7)*

Petitioner argues that claims 2–4, 17, 18, 24, 29, and 30 are unpatentable over Vosteen and Nelson. Pet. 74–87.

*1. Nelson*

Nelson is a patent titled "Sorbents and Methods for the Removal of Mercury from Combustion Gases." Ex. 1012, code (54). Nelson "relates to the removal of mercury from combustion gas streams and more specifically to the use of halogenated carbon materials to reduce the emissions of mercury from coal-fired power plants." *Id.* at 1:24–27.

Nelson's Figure 1 is reproduced below.

**Figure 1.**

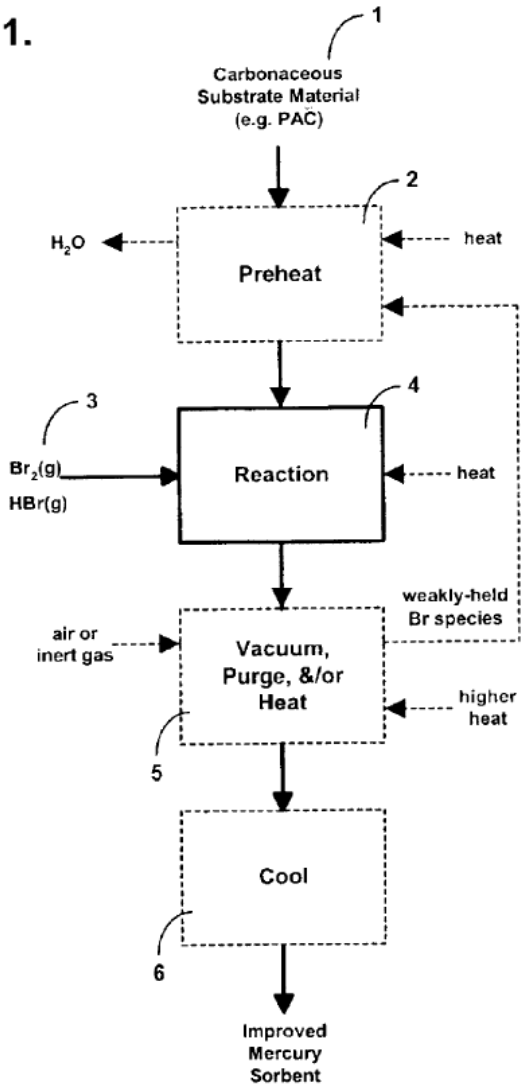



Figure 1 depicts a mercury sorbent manufacturing process. *Id.* at 5:28–29. Nelson discloses that the process shown in Figure 1 begins with carbonaceous substrate material 1 for a mercury sorbent. *Id.* at 7:4–5. The carbonaceous material can be activated carbon. *Id.* at 7:7–8.

Nelson states that a "critical element in the process is that a bromine-containing gas 3 is used to treat the carbonaceous substrate. Preferably this gas comprises elemental bromine, $Br_2(g)$, although other bromine-containing gases, such as hydrogen bromide, HBr, will also have the advantageous effect of the invention." *Id.* at 7:46–51. Nelson further discloses that the

mercury sequestration performance of activated carbons can be improved when the latter are combined with halogen compounds. *Id.* at 2:10–12.

*2. Analysis*

Petitioner's arguments for this ground, including their rationale for combining the references, do not remedy the deficiencies discussed above with regard Ground 1 based on Vosteen. Pet. 74–87. Therefore, Petitioner has not demonstrated a reasonable likelihood of prevailing on its assertion that claims 2–4, 17, 18, 24, 29, and 30 of the '114 patent would have been unpatentable over Vosteen and Nelson.

*L. Asserted Obviousness over Downs-Boiler and Nelson (Ground 8)*

Petitioner argues that claims 2–4, 18, 24, 29, and 30 are unpatentable over Downs-Boiler and Nelson. Pet. 74–87.

Patent Owner does not present arguments addressing the specific merits of Petitioner's ground in the Preliminary Response. Having reviewed Petitioner's assertions regarding claims 2–4, 17,[7] 24, 29, and 30, as well as the cited portions of Downs-Boiler and Nelson, we determine that Petitioner has demonstrated a reasonable likelihood of establishing that claims 2–4, 17, 24, 29, and 30 would have been obvious over Downs-Boiler and Nelson.

We have reviewed Petitioner's argument and evidence that Downs-Boiler and Nelson disclose the limitations of the remaining challenged claim 18. Pet. 74 ("Elements and claims not mentioned below are disclosed or rendered obvious for the reasons stated above in . . . Grounds 3-4 (Nelson)."), 67–74. Patent Owner does not address Petitioner's challenges

[7] Petitioner does not explicitly identify claim 17 as being challenged under this ground (*see* Pet. 10, 74) but presents arguments directed to claim 17 as obvious in view of Downs-Boiler and Nelson (*see* Pet. 86–87). Therefore, on this record, we consider claim 17 to be part of this Ground 8.

to this challenged claim. Based on the preliminary record before us, we also find that Petitioner's argument and evidence is sufficient to show a reasonable likelihood Petitioner would prevail in proving unpatentability of claim 18.

*M. Availability of Prior Art and Priority of '114 Patent*

Petitioner asserts that Vosteen is prior art. Pet. 9 (table indicating that Vosteen was "filed 5/6/2003, and issued 4/12/2005); 10 ("Each reference is also prior art under §102(b) (pre-AIA) and §102(a)(1) (post-AIA)."). Petitioner also asserts that Downs-Boiler is prior art, "with a priority date back to the March 22, 2004 filing date of 60/555,353," the "'Downs-Boiler Provisional' (Ex[1007])." *Id*. at 44 (citing *Dynamic Drinkware*, 800 F.3d at 1378; *Amgen Inc. v. Sanofi*, 872 F.3d 1367, 1380 (Fed. Cir. 2017) (finding that *Dynamic* applies to published patent applications). Petitioner further argues that the "disclosure of Downs-Boiler is supported by Downs-Boiler-Provisional, as illustrated in a redline between the two. Ex[1032]." *Id.*

Patent Owner argues that the primary references fail to qualify as prior art because "the inventors actually reduced the '114 invention to practice before the asserted Downs-Boiler § 102(e) date, and they conceived of the '114 invention before the asserted Vosteen § 102(e) date." Prelim. Resp. 16. Specifically, Patent Owner argues that the inventors of the '114 patent "conceived of the invention at least by August 2002" and "reduced the challenged claims to practice at least as early as September 2003." *Id.* at 19; *see also id.* at 19–21, 23–28. Patent Owner presents evidence in the form of declaration testimony and a "research ideas" file to support its argument that the inventors had "conceived of using bromine as the pre-combustion additive" by August 2002. *Id.* at 22 (citing Ex. 2024 ¶¶ 25–30; Ex. 2014). Patent Owner presents further evidence in the form of

declaration testimony, logbooks, and reports to support its argument that the inventors reduced the invention to practice "through pilot scale testing conducted in September 2003, December 2003, and February 2004." *Id.* at 27 (citing Ex. 2024; Ex. 2016; Ex. 2011–2013). Patent Owner argues that the relevant period for establishing diligence "is from May 5, 2003 to September 18, 2003" and that the "inventors were reasonably diligent in obtaining funding for PTC testing and then carrying out that testing." *Id.* at 28–29.

Petitioner disputes Patent Owner's assertion of an earlier actual reduction to practice. Pet. Reply. 1–2, 6–9. More particularly, Petitioner argues that "Patent Owner has not come forward with evidence of conception or reduction to practice of every claim limitation to pre-date" Vosteen and Downs-Boiler, decrying Patent Owner's evidence as "a hodgepodge compilation of future research ideas from unnamed individuals" and "unwitnessed laboratory notebook(s)" that "fail to disclose adding the claimed species of bromine-containing ingredients to coal and to the combustion chamber, and numerous other claim limitations." *Id.* at 1. Petitioner argues that trial should be instituted so it may depose Patent Owner's declarants. *Id.* at 2. Petitioner also presents detailed arguments against Patent Owner's conception evidence (*id.* at 4–6), reduction to practice evidence (*id.* at 6–9), and diligence evidence (*id.* at 9).

Patent Owner replies that Petitioner misunderstands the "rule of reason" for a conception date. Sur-reply 3. Patent Owner also replies that Petitioner failed to show that the inventors' asserted reduction to practice date lacks credibility. *Id.* at 5. Finally, Patent Owner argues that Petitioner failed to show that the inventors lacked diligence. *Id.* at 8.

To remove a patent as a prior art reference, the record must establish either (1) a conception and reduction to practice before the filing date of the patent or (2) a conception before the filing date of the patent combined with diligence and reduction to practice after that date. *See Taurus IP, LLC v. DaimlerChrysler Corp.*, 726 F.3d 1306, 1323 (Fed. Cir. 2013).

"Conception exists when a definite and permanent idea of an operative invention, including every feature of the subject matter sought to be patented, is known." *Sewall v. Walters*, 21 F.3d 411, 415 (Fed. Cir. 1994). Furthermore, the "conception analysis necessarily turns on the inventor's ability to describe his invention with particularity. Until he can do so, he cannot prove possession of the complete mental picture of the invention." *Burroughs Wellcome Co. v. Barr Labs., Inc.*, 40 F.3d 1223, 1228 (Fed. Cir. 1994). Objective evidence that corroborates an inventor's testimony regarding the conception of the invention is required "because of the danger in post-hoc rationales by an inventor claiming priority." *Invitrogen Corp. v. Clontech Labs., Inc.*, 429 F.3d 1052, 1065 (Fed. Cir. 2005). The sufficiency of corroboration is determined according to a "rule of reason." *Price v. Symsek*, 988 F.2d 1187, 1195 (Fed. Cir. 1993). Under the rule of reason, "all pertinent evidence is examined in order to determine whether the inventor's story is credible." *Fleming .v Escort Inc.*, 774 F.3d 1371, 1377 (Fed. Cir. 2014) (quoting *Sandt Tech., Ltd. v. Resco Metal & Plastics Corp.,* 264 F.3d 1344, 1350 (Fed. Cir. 2001)).

To establish an actual reduction to practice, as opposed to the constructive reduction to practice that occurs when a patent application is filed, a party must establish that: (1) the inventor constructed an embodiment or performed a process that satisfies every element of the claim at issue; and (2) the inventor determined that the invention would work for its intended

purpose. *E.I. du Pont De Nemours & Co. v. Unifrax I LLC*, 921 F.3d 1060, 1075 (Fed. Cir. 2019). The same requirement for evidence that corroborates inventor testimony on conception under the rule of reason also applies to the reduction to practice determination. *Id.* at 1076. To demonstrate diligence, a patent owner "must show there was *reasonably continuous* diligence" throughout the critical period. *Perfect Surgical Techniques, Inc. v. Olympus Am., Inc.*, 841 F.3d 1004, 1009 (Fed. Cir. 2016).

Petitioner bears the burden of persuasion that the challenged claims are unpatentable, which includes the burden of establishing that any reference upon which it relies constitutes prior art under 35 U.S.C. § 102. *See* 35 U.S.C. § 316(e); *Mahurkar v. C.R. Bard, Inc.*, 79 F.3d 1572, 1576 (Fed. Cir. 1996) (holding that the challenger "bore the burden of persuasion . . . on all issues relating to the status of [the asserted reference] as prior art"). However, because Petitioner initially offered up the prior art references, which qualify on their face as prior art, into evidence, Patent Owner bears the subsequent procedural burden of producing evidence antedating the prior art references. *See Dynamic Drinkware*, 800 F.3d at 1378–80; *Magnum Oil*, 829 F.3d at 1375. Although the burden of production can be a shifting burden, we note that the burden of persuasion is on Petitioner to ultimately prove "unpatentability by a preponderance of the evidence," and that this burden never shifts to Patent Owner. *Dynamic Drinkware*, 800 F.3d at 1378.

Petitioner has come forward with evidence to support its assertion that the prior art references are in fact prior art. *See* Pet. 9–10, 44. Patent Owner has come forward with evidence and argument that the proffered prior art references are not, in fact, prior art, due to the asserted prior conception, reduction to practice, and diligence on the part of the inventors. *See* Prelim.

Resp. 19–28; Sur-reply 3–9. However, on this record and at this preliminary stage, we are not persuaded that the evidence and arguments before us are sufficient to show the asserted conception date, reduction to practice date(s), or diligence. Most importantly, Patent Owner does not explain in sufficient detail how the proffered testimony and documents disclose every feature of the subject matter challenged. It is also unclear, without further explanation, what the documents that purport to show conception and reduction to practice actually demonstrate, and how they are related specifically to the limitations of the challenged claims.

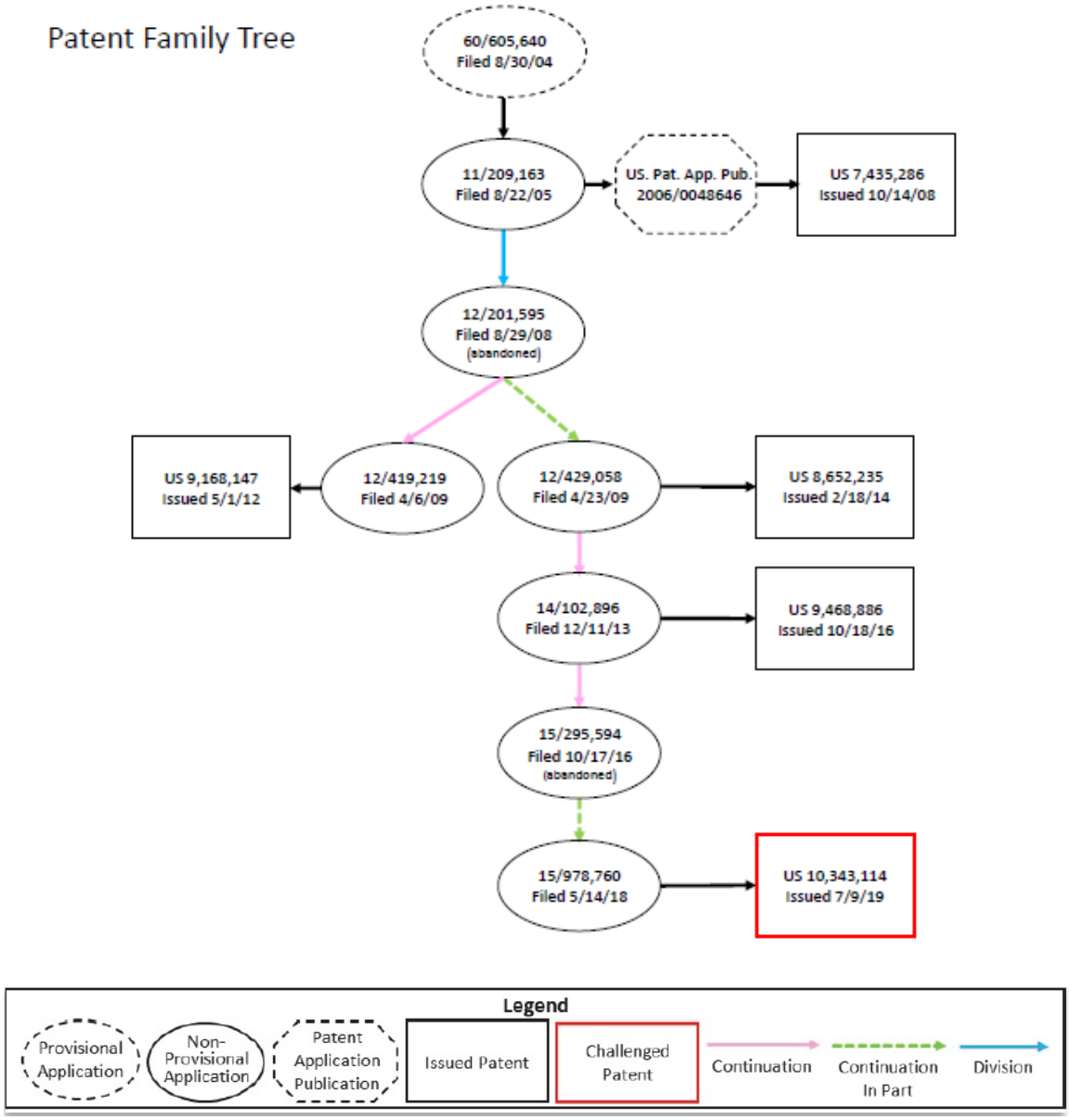
Accordingly, based on the preliminary record, we determine that, for purposes of this Decision, Vosteen and Downs-Boiler constitute prior art under 35 U.S.C. § 102. The parties may further address this issue in post-institution briefing.

Petitioner also replies that "Patent Owner has not satisfied its burden of production to antedate prior art patent documents *filed and published* years before the May 2018 filing of the '114 Patent." Reply 1. Specifically, Petitioner asserts that "Patent Owner has not come forward with *any* evidence that the '114 Patent traces priority through two continuation-in-part (CIP) applications and three other applications to avoid §102(a)(2) (post-AIA) or §102(b) (pre-AIA) statutory bars." *Id.*

Patent Owner asserts that Petitioner "initially attempted to justify their filing of multiple IPR petitions by arguing that the -832 proceeding would address the parties' priority date dispute, and the -834 proceeding would assume that the '114 patent is entitled to its earliest claimed priority date" but that Petitioner now asks "the Board to reach the opposite conclusion and insist that the parties' priority date dispute should be addressed in both proceedings." Sur-reply 1. Patent Owner argues that because "Petitioners

previously indicated that the -834 proceeding would not address the parties' priority date dispute, they may not raise the issue after the fact." *Id.* at 1–2 (citing *Magnum Oil*, 829 F.3d at 1381; *SAS Inst., Inc. v. ComplementSoft, LLC*, No. 2015-1347, 825 F.3d 1341, 1351 (Fed. Cir. June 10, 2016)). However, Patent Owner further contends that, for "all of the reasons addressed in the parties' -832 briefing, the Board should determine that the '114 patent is entitled to the earliest claimed priority date" and "the evidence required to evaluate this issue, i.e., the priority applications, is already before the Board. Exs. 1017–1026. As explained in the -832 proceeding, those applications support the claims." *Id.* at 2, 2 n.1.

Petitioner provides the following summary of the '114 patent's priority chain and family:




Ex. 1017. This summary depicts the earliest filed application at the top and shows the latest filed application at the bottom. As illustrated above, the '114 patent has the following priority chain:

- Provisional Application 60/605,640, filed August 30, 2004, ("the provisional application");

- Non-provisional Application 11/209,163 ("the '163 application"), filed August 22, 2005, claiming priority to the Provisional Application;
- Non-provisional Application 12/201,595 ("the '595 application"), filed August 29, 2008, claiming priority to the '163 application as a divisional application;
- Non-provisional Application 12/429,058 ("the '058 application"), filed April 23, 2009, claiming priority to the '595 application as a continuation-in-part;
- Non-provisional Application 14/102,896 ("the '896 application"), filed December 11, 2013, claiming priority to the '058 application as a continuation;
- Non-provisional Application 15/295,594 ("the '594 application"), filed October 17, 2016, claiming priority to the '896 application as continuation; and
- Non-provisional Application 15/978,760 ("the '760 application"), filed May 14, 2018, claiming priority to the '594 application as a continuation-in-part.

*Id.*; Ex. 1001, code (21), (22), (60). Therefore, if the '114 patent is entitled to the priority date of the provisional application, Downs-Boiler and Vosteen would not qualify as prior art to the '114 patent.

Patent Owner contends that Petitioner raises this issue as a new argument in Petitioner's Reply. Sur-reply 1. Petitioner, however, appears to make its Reply argument in response to Patent Owner's assertion of a prior invention date in their Preliminary Response, stating that "Patent Owner's assertions of an earlier invention date cannot overcome" the statutory bars of

§102(a)(2) (post-AIA) or §102(b) (pre-AIA) because determining "invention date for Rule 1.131 is a separate inquiry from determining effective filing date for a chain of patent applications." Reply 2. In response, Patent Owner presents its own arguments regarding the priority date issue, asserting that the '114 patent is entitled to its earliest claimed priority date for the reasons discussed in IPR2020-00832. Sur-reply 2 n.1.

The Petition in this case does not raise the same priority date arguments made in IPR2020-00832, but the Reply in this case raises these arguments in response to Patent Owner's arguments by referring to the arguments raised in the IPR2020-00832 Petition. Patent Owner's Sur-reply refers to and invites us to consider the priority date arguments raised and evidence presented in IPR2020-00832. In the IPR2020-00832 Institution Decision, we analyze this priority date issue in depth based on the parties' arguments and evidence presented in that proceeding. We are aware of the potential problems that could arise if we were to ignore or fail to address a priority date issue in this case, when the same potentially dispositive issue has been raised and analyzed in IPR2020-00832 concerning the same patent and the same priority date evidence. Patent Owner argues that Petitioner may not "raise the issue after the fact," but we are not directed to any authority indicating that we must disregard this potentially dispositive issue entirely, particularly if the parties are on notice that the issue is relevant to this proceeding. Sur-reply 1–2 (citing *Magnum Oil*, 829 F.3d at 1381; *SAS,* 825 F.3d 1341). Finally, we are aware that Petitioner elected to take two different priority date approaches in the Petitions in IPR2020-00832 and IPR2020-00834, for the purposes of qualifying each petition for separate institution. Paper 2, 1–2 ("Explanation"). This drafting choice results in two Petitions that ostensibly present different sets of evidence, but that may

end up turning on the same priority date issue raised in IPR2020-00832. The conception, reduction to practice, and diligence issues raised here, however, distinguish this case sufficiently that our reasoning for granting institution in both petitions, further explained below, is unchanged.

In view of the above, we acknowledge that the priority of the '114 patent and whether the applications of the '114 patent's priority chain comply with the written description requirement may be another reason to question whether the references asserted in this proceeding are available as prior art.

*N. Discretion under 35 U.S.C. § 325(d)*

Petitioner argues that the "Board should not deny institution under 35 U.S.C. § 325(d), because the Examiner did not consider some of the asserted references, and for the remainder, the Office erred in a manner material to the patentability of the challenged claims." Pet. 11. More particularly, Petitioner argues that EPA-Proposal "was not considered by the Examiner during prosecution" (*id.*); the Examiner "did not use Downs-Boiler in a substantive rejection" and "erred by not citing Downs-Boiler during prosecution" (*id.* at 12); and the Examiner "cited Vosteen early in prosecution" but "erred in overlooking the teachings of" Vosteen (*id.* at 12–13). Patent Owner does not address Petitioner's EPA-Proposal and Downs-Boiler arguments, but argues that the Board should exercise its discretion to deny institution under 35 U.S.C. § 325(d), because Vosteen was previously before the Office during prosecution of the '760 application. Prelim. Resp. 1–7 (citing Ex. 1026, 2003).

> To evaluate whether to exercise discretion under 35 U.S.C. §325(d), the Board uses the following two-part framework: (1) whether the same or substantially the same art previously was presented

> to the Office or whether the same or substantially the same arguments previously were presented to the Office; and (2) if either condition of first part of the framework is satisfied, whether the petitioner has demonstrated that the Office erred in a manner material to the patentability of challenged claims.

*Advanced Bionics LLC v. MED-EL Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6 at 8 (PTAB Feb. 13, 2020) (precedential). The factors set forth in *Becton, Dickinson & Co. v. B. Braun Melsungen AG*, IPR2017-01586, Paper 8 (PTAB Dec. 15, 2017) (precedential as to § III.C.5, first paragraph) provide insight into how to apply the framework, because *Becton, Dickinson* factors (a), (b), and (d) relate to part (1) of the framework and factors (c), (e), and (f) relate to part (2).

*1. Advanced Bionics Framework Part (1)*

For part (1) of the *Advanced Bionics* framework (and factors (a), (b), and (d) of *Becton, Dickinson*), Patent Owner contends that "Vosteen was described in the '114 patent's specification, cited in an IDS, and identified by the examiner in a rejection." Prelim. Resp. 4. According to Patent Owner, "the prosecution record reflects that this reference was sufficiently considered such that the examiner's decision to allow the claims is entitled to deference." *Id*. Petitioner contends that the "Examiner cited Vosteen early in prosecution to reject then-pending claims 20–21, but only as a secondary reference for features recited in a dependent claim related to 'monitoring the mercury content,'" and those claims were later cancelled. Pet. 12 (citing Ex. 1026, 75–79, 1530–1531, 1569).

Vosteen was, therefore, before the Office during prosecution of the challenged patent. Ex. 1026, 75–79, 1530–1531. It does not appear, however, that the same or substantially the same arguments predicated on Vosteen were before the Office. *Id.* Moreover, EPA-Proposal was not

before the Office, and Downs-Boiler, although one of the sixteen columns' worth of cited references on the face of the '114 patent, was not substantively considered by the Examiner. Pet. 12. Thus, Part (1) of the framework is not met as to EPA-Proposal and Downs-Boiler, nor is it met with respect to the same or substantially the same Vosteen arguments being before the Office. However, Vosteen was previously before the Office, and we review Part (2) of the framework with respect to Vosteen.

*2. Advanced Bionics Framework Part (2)*

For part (2) of the *Advanced Bionics* framework (and factors (c), (e), (f) of *Becton, Dickinson*), Petitioner argues that, following the Examiner's rejection based on Vosteen, "the claims underwent significant amendments" and the amended claims "were prosecuted without citation by the Examiner to Vosteen." Pet. 13 (citing Ex. 1026, 1646 (claim 7), 1905–1911). Therefore, Petitioner alleges, "the 'Office erred in overlooking the teachings of' Vosteen" because, for example, Vosteen "clearly discloses bromine addition to the coal and/or combustion chamber, along with separation via activated carbon, and highlights the Examiner's error in overlooking Vosteen's teachings." *Id.*

Patent Owner argues that Petitioner "offers no authority indicating that the Board should avoid deferring to an examiner based on the assumption that the examiner forgot about a reference when evaluating later amended claims." Prelim. Resp. 4–5. Rather, Patent Owner argues, the Examiner "allowed claim scope coverage for those embodiments" where bromine is provided on coal, into the combustion chamber, or via some other step, "even when well aware of Vosteen." *Id.* at 5.

We find that Petitioner has sufficiently shown how the Examiner failed to fully consider the aspects of Vosteen not related to "monitoring the

mercury content," such as the amended claims requiring that "coal must comprise particular bromine-containing species." Pet. 12–13 (citing Ex. 1026, 75–79, 1530–1531, 1646 (claim 7), 1905–1911). *See Advanced Bionics*, Paper 6, 8 n.9 ("An example of a material error may include misapprehending or overlooking specific teachings of the relevant prior art where those teachings impact patentability of the challenged claims."). Although we have preliminarily analyzed Vosteen and determined that it does not anticipate or provide the basis for an obviousness ground against the challenged claims, this preliminary determination does not conflict with our Part (2) determination that the Examiner erred in not considering Vosteen in a manner potentially material to the patentability of the challenged claims.

For these reasons, considering the *Advanced Bionics* framework as applied to the various references before us, we decline to exercise our discretion under § 325(d) to deny institution.

*O. Discretion under 35 U.S.C. § 314(a)*

Under § 314(a), we have discretion to deny institution of an *inter partes* review. *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2140 (2016); *SAS Inst. Inc. v. Iancu*, 138 S. Ct. 1348, 1356 (2018); *Harmonic Inc.*, 815 F.3d at 1367 ("[T]he PTO is permitted, but never compelled, to institute an IPR proceeding."); see also 37 C.F.R. § 42.4(a) ("The Board institutes the trial on behalf of the Director."). In deciding whether to institute an *inter partes* review, we consider the guidance in the Consolidated Trial Practice Guide, which states

> Based on the Board's prior experience, one petition should be sufficient to challenge the claims of a patent in most situations. Two or more petitions filed against the same patent at or about the same time . . . may place a substantial and unnecessary burden

> on the Board and the patent owner and could raise fairness, timing, and efficiency concerns.

Patent Trial and Appeal Board Consolidated Trial Practice Guide ("CTPG") 64 (Nov. 2019), https://www.uspto.gov/sites/default/files/documents/tpgnov.pdf, 59.

Here, Petitioner filed two petitions on the same day, both challenging claims 1–9 and 12–30 of the '114 patent. In this Petition, Petitioner presents two anticipation grounds, one based on Vosteen and one based on Downs-Boiler, and six obviousness grounds based on either Vosteen or Downs-Boiler and additional references. Pet. 10. In IPR2020-00832, Petitioner presents two obviousness challenges, the first based on Sjostrom and Eckberg and the other based on Sjostrom and Olson-646. IPR2020-00832, Paper 3, 10.

Petitioner's Explanation Regarding the Necessity of Multiple Petitions argues that "[g]iven the strength of the prior-art references on the merits, and noncumulative nature of the references, both petitions should be instituted." Explanation 2. The Explanation ranks this Petition above the Petition in IPR2020-00832. *Id*.

The Explanation further argues why Petitioner believes institution of both petitions is appropriate. *Id.* at 3–5. Specifically, Petitioner contends that the two petitions assert different priority dates and assert different references, citing the CTPG's statement that "more than one petition may be necessary . . . when there is a dispute about priority date requiring arguments under multiple prior art references." *Id.* at 3 (citing CTPG 59). Petitioner further argues that the issues presented to the Board by the two Petitions are limited, because the Petition in this proceeding uses two primary references and two secondary references, whereas the Petition in IPR2020-00832 uses

only one primary reference and two secondary references. *Id.* at 3–4. Petitioner also contends that Patent Owner may attack obviousness grounds for dependent claims in IPR2020-00832 via evidence of secondary considerations. *Id.* at 4. In view of this possibility, Petitioner requests that the Board also institute in this proceeding because Petitioner argues Olson-646 discloses numerous limitations of the same dependent claims. *Id.* Petitioner also argues that they joined efforts to provide efficiency instead of each party individually filing separate petitions. *Id.* at 4–5.

Petitioner's arguments are persuasive. The existence of different priority date arguments and different prior art references in the two petitions before us invokes the CTPG statement that "more than one petition may be necessary . . . when there is a dispute about priority date requiring arguments under multiple prior art references." CTPG 59. Notwithstanding Petitioner's and Patent Owner's post-Petition arguments regarding the similarity of the priority date arguments, the fact remains that the Petitions themselves present different priority date arguments and rely on different prior art references. The Petitions are the documents to which the Patent Owner will be responding in the *inter partes* review proceeding. Moreover, Petitioner ranks this Petition first and, for the reasons discussed above, *inter partes* review will be instituted in this proceeding. We also institute *inter partes* review in IPR2020-00832 for the reasons discussed in that proceeding.

## III. CONCLUSION

For the reasons set forth above, we determine that Petitioner has demonstrated a reasonable likelihood of prevailing with respect to at least one challenged claim of the '114 patent. Thus, we institute an *inter partes* review on all challenged claims and on all grounds presented.

## IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that an *inter partes* review is instituted on each of the grounds asserted in the Petition; and

FURTHER ORDERED that, pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is hereby given of the institution of a trial, which shall commence on the entry date of this decision.

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